

CLAIMS:

We claim:

1. A process for landfill gas treatment and separation of methane gas and carbon dioxide gas contained therein, and for producing natural gas, carbon dioxide, and
5 regenerating the carbon dioxide absorption material, comprising the steps of;
 flowing landfill methane gas from wells to a collector;
 conducting the gas from the collector to a first separator and separating any heavier liquids and solids in the gas flowing into the first separator;
 compressing the gas from the first separator and conducting it to an absorber having
10 an absorbent therein;
 mixing the gas and an absorbent to produce carbon dioxide saturated absorbent and purified methane gas containing little carbon dioxide;
 separating much of the carbon dioxide and methane gas from the carbon dioxide saturated absorbent in a second separator;
15 removing any excess water vapor from the purified methane gas in one of two alternate dehumidifying absorbers with an adsorbent;
 regenerating the adsorbent in either of the two dehumidifying absorbers by supplying gas from the second separator;
 conducting the gas used to regenerate the adsorbent from the dehumidifying absorber
20 to the first separator;
 switching between regenerating the adsorbent and dehumidifying the purified methane gas; and
 regenerating the carbon dioxide saturated absorbent.
2. The system of claim 1, wherein the absorbent in the first absorber comprises
25 propylene carbonate.

3. The system of claim 1, wherein the adsorbent in the dehumidifying absorbers comprises silica gel.

4. The system of claim 1, wherein opening and closing electric valves switches between regeneration of the adsorbent and dehumidification of the purified methane gas.

5 5. The system of claim 4, wherein switching to dehumidifying the purified methane gas further comprises:

opening an electric valve to connect the first absorber and the dehumidifying absorber;

closing an electric valve to separate the second separator from the dehumidifying
10 absorber;

closing an electric valve to separate the dehumidifying absorber from the first separator.

6. The system of claim 4, wherein switching to regenerating the adsorbent further comprises:

15 closing an electric valve to separate the first absorber from the dehumidifying absorber;

opening an electric valve to connect the second separator to the dehumidifying absorber;

opening an electric valve to connect the dehumidifying absorber to the first separator.

20 7. The system of claim 1, wherein the carbon dioxide saturated adsorbent is regenerated by:

degassing the carbon dioxide saturated adsorbent in a desorber connected to the second separator, thereby producing regenerated adsorbent and carbon dioxide gas;

maintaining a vacuum in the desorber to cause a deeper regeneration of the carbon
25 dioxide saturated adsorbent to take place;

conducting the regenerated absorbent to a tank connected to the desorber;
compressing the regenerated absorbent with a suction pump;
smoothing the pulsation of the regenerated absorbent with a liquid depressurizer
connected to the suction pump;

5 conducting the regenerated absorbent to the first absorber.

8. An apparatus for landfill gas treatment and separation of methane gas and carbon dioxide gas contained therein, and for producing natural gas, carbon dioxide, and regenerating the carbon dioxide absorption material, comprising:

- gas wells providing a source of landfill methane gas;
- 10 a collector connected to the gas wells;
- a first separator connected to the collector, the separator capable of separating any heavier liquids and solids in the landfill methane gas flowing into the first separator;
- a compressor unit connected to the collector that compresses the gas exiting the first separator;
- 15 a first absorber connected to the compressor unit in which an absorbent and the landfill methane gas are mixed, thereby producing a carbon dioxide saturated absorbent and methane gas from which most of the carbon dioxide has been extracted;
- a second separator connected to the first absorber in which much of the carbon dioxide and methane is separated from the carbon dioxide saturated absorbent;
- 20 a first dehumidifying absorber connected to the first absorber, the second separator, and the first separator;
- a second dehumidifying absorber connected to the first absorber, the second separator, and the first separator;
- an adsorbent contained within the first and second absorbers;

a gas dehumidification configuration in which the adsorbent strips water from the purified methane gas exiting the first absorber;

a regeneration configuration in which gas from the second separator strips water from the adsorbent in the first or second dehumidifying absorbers before conducting the gas from
5 the second separator to the first separator;

a means for switching the first and second absorbers from the gas dehumidification configuration to the regeneration configuration,

a desorber apparatus connected to the second separator and the first absorber that removes most of the carbon dioxide from the saturated adsorbent before conducting the
10 regenerated adsorbent to the first absorber.

9. The system of claim 8, wherein the adsorbent in the first absorber comprises propylene carbonate.

10. The system of claim 8, wherein the adsorbent in the dehumidifying absorbers comprises silica gel.

15 11. The system of claim 8, wherein the means for switching the first and second absorbers between the gas dehumidification configuration and the regeneration configuration comprises electric valves.

12. The system of claim 11, wherein the gas dehumidification configuration further comprises:

20 an open electric valve connecting the first absorber and the dehumidifying absorber;

a closed electric valve separating the second separator from the dehumidifying absorber;

a closed electric valve separating the dehumidifying absorber from the first separator.

13. The system of claim 11, wherein the regeneration configuration further
25 comprises:

a closed electric valve separating the first absorber from the dehumidifying absorber;
an open electric valve connecting the second separator to the dehumidifying absorber;
an open electric valve connecting the dehumidifying absorber to the first separator.

14. The system of claim 8, wherein the desorber apparatus further comprises:
- 5 a desorber connected to the second separator that degasses the carbon dioxide saturated absorbent from the second separator to produce regenerated absorbent and carbon dioxide gas;
- a vacuum pump connected to the desorber that causes a deeper regeneration of the carbon dioxide saturated absorbent to take place;
- 10 a tank connected to the desorber into which the regenerated absorbent from the desorber flows;
- a suction pump connected to the tank that compresses the regenerated absorbent;
- a liquid depressurizer connected to the suction pump that smoothes the pulsation of the liquid;
- 15 a pipe connecting the liquid depressurizer to the first absorber, thereby conducting the regenerated absorbent to the first absorber.